INTRODUCTION

This module describes the rationale and methods used in establishing hot, warm, and cold zones (radiological control zones). The Emergency Response Guidebook (ERG) helps you establish guidelines for safe control zones. Considerations for selecting personal protective equipment (PPE), and basic radiological protection principles, at the scene of an incident involving radioactive material will be discussed.

PURPOSE

The purpose of this module is to increase your understanding of some basic tactics and strategies that can be used at the scene of an incident involving radioactive material. Once you understand these tactics and strategies, you will help control the spread of radiological contamination and minimize personnel exposure to ionizing radiation.

MODULE OBJECTIVES

Upon completion of this module, you will be able to:

1. Describe reasons for and methods of establishing hot, warm, and cold zones at the scene of a transportation incident involving radioactive material.
2. Describe methods for implementing radiological controls at the scene of a transportation incident involving radioactive material.
3. Describe considerations for selecting PPE for responders working at the scene of a transportation incident involving radioactive material.

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ESTABLISHING CONTAMINATION CONTROL ZONES

As with other hazardous material incidents, contamination control zones can be used to limit the spread of contamination and control access into the immediate hazard area or hot zone. Since medical emergencies take priority over radiological controls, formal control zones can be established after patients with life-threatening injuries are removed from the incident scene. Or, if enough personnel are available, control zones can be established while rescue operations are taking place.

Control zones should be established following your local procedures; however, they may be similar to these:

- Entry and exit points into the controlled area should be established upwind and upslope of the hot zone or immediate hazard area
- The Emergency Response Guidebook may be used to determine initial isolation distances
- The size of the control zones may vary depending on the size of the spill, weather conditions, and whether or not the material is involved in a fire

The responder's primary functions should be to:

- Perform rescue operations while attempting to avoid the immediate hazard area or spilled material
- Attempt to contain any released material. Establishing a control zone around the release area will help contain the material
- Keep the release from spreading. Extinguishing any fires, using good contamination control techniques, and properly using protective clothing will help minimize the spread of contamination

In this text, the term "control zone" generically refers to the isolation zone that is typically set up around a hazardous incident site to control the spread of hazardous substances. Often, several site work zones are set up surrounding the immediate hazard or spill area. There is no specific rule on the number of zones that should be created at an incident scene; the three most commonly used zones are:

The Hot Zone

Also referred to as the exclusion zone. According to the ERG, the initial hot zone should be established 80 to 160 feet around the spilled material. Access to the hot zone should be controlled for accountability purposes as well as contamination control purposes. Keep track of time spent in the hot zone for radiation dose control purposes.

The Warm Zone

Also referred to as the contamination reduction zone, the warm zone should be established around the hot zone to provide a buffer between the hot and cold zones. The size of the warm zone will depend on many variables including the size of the spill, weather conditions, whether or not the material is on fire, etc. Many jurisdictions will base the size of the warm zone on radiological conditions, and will establish the boundary between the warm and cold zone at the point where radiation levels are at or near natural background levels.

The Cold Zone

Also referred to as the support zone, the cold zone is a contamination-free zone established around the warm zone where emergency operations can be directed and supported. The cold zone should be established in an area where radiation levels are at natural background levels.

Access into the cold zone should be controlled to limit entry of unauthorized personnel. This may require several control points if multiple access routes are available to the incident scene. The Incident Commander should approve all requests for entry into the cold zone.

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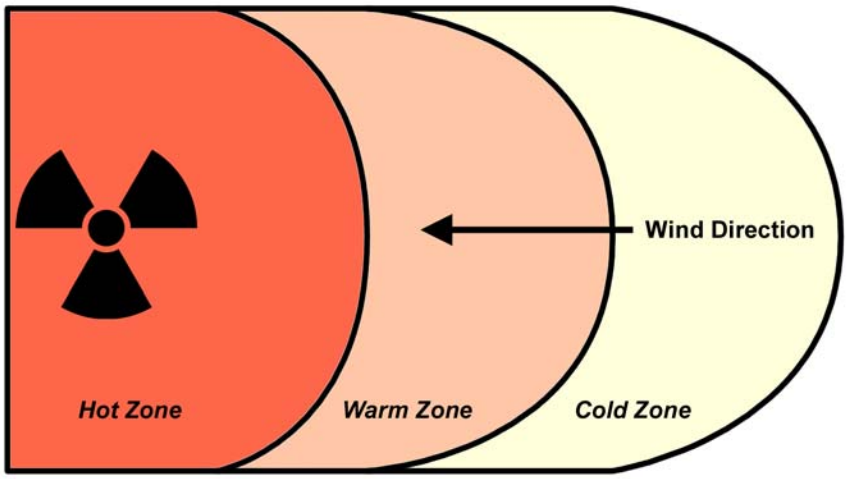

Control Zones

Removing Personnel and Equipment From the Control Zone

Entry and exit protocols need to be established for all personnel working in and around the hot zone. Once personnel and equipment enter the hot zone, they should be surveyed prior to being released from the area. While waiting to be surveyed, do not eat, drink, smoke, or chew. This will help prevent internal contamination.

Equipment waiting to be removed from the hot zone should be placed in a holding area inside the hot zone until it can be surveyed by personnel trained in the use of radiological survey instruments.

RADIOLOGICAL CONTROLS

By implementing proper radiological controls at the scene of an incident involving radioactive material, personnel radiation exposure can be kept to a minimum. There are three radiation protection principles that you can use to minimize the amount of external radiation exposure received at an incident involving radioactive material. These radiation protection principles involve the use of time, distance, and shielding.

APPLICATION OF PROTECTION PRINCIPLES

While these protection principles are not unique to radioactive material response situations, they can greatly reduce the risks involved when radioactive material is present. A responder, when required to respond to a transportation incident involving radioactive material, should:

- Spend as little **TIME** as possible near the radiation source
- Maintain **DISTANCE** from the radiation source
- Wear protective clothing and use available **SHIELDING**

Time, distance, and shielding are factors that can be controlled to reduce **external** radiation exposure. It is also important to reduce the potential for radioactive material to enter the body. Extinguishing any fires, establishing contamination control zones, using good contamination control techniques, and the proper use of protective clothing will help keep contamination from spreading and help minimize the potential for internal contamination.

Other steps you can take to reduce the potential for internal contamination include:

- Approach the incident and/or patient(s) from upwind and upslope when possible
- Cover exposed wounds or cuts before entering any area where radioactive contamination may be present
- Do not eat, drink, smoke, or chew in areas where radioactive contamination may be present
- Avoid touching exposed skin surfaces while wearing protective gear or while working with potentially contaminated patients
- Use respiratory equipment to prevent inhalation of radioactive material

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SELECTING PROTECTIVE CLOTHING

Protective clothing and personal protective equipment (PPE) should be used when entering areas where a radiological hazard is present or suspected. The degree of protective clothing required depends on the nature of the job or task being performed (e.g., walking into the area to retrieve shipping papers, kneeling or lying on ground performing rescue operations, etc.). If airborne contamination is suspected (e.g., the material is involved in a fire), respiratory protection should be worn. Firefighter turnout or bunker gear provides very effective protection against radioactive contamination. Remember that protective clothing will help prevent contamination of your skin or clothing.

Something to consider when selecting protective clothing is disposal vs. decon. If turnout gear is worn into a contamination area and becomes contaminated, it will need to be decontaminated. If decontamination efforts are unsuccessful, the gear will need to be disposed of as radioactive waste. For this reason, disposable coveralls (e.g., Tyvek®) are often used; they are less expensive than turnout gear. Disposable or paper coveralls are effective against radioactive contamination but may not protect against other hazards that may be present. For this reason, the selection of PPE should be based on other hazards that may be present (spilled fuel, etc.).

If you intend to use disposable protective clothing, remove objects that might puncture it (i.e., pens, pencils, gun belt) before donning.

Follow local procedures for donning and doffing disposable protective clothing. The following sequence illustrates how disposable protective clothing may be donned:

1. Disposable boots.
2. Disposable coveralls. Legs of coveralls go over boots and are taped at ankle.
3. Respirator or respiratory protection (if applicable).
4. Hood. Many disposable coveralls have a hood attached. Use tape to secure hood to respirator if one is worn.
5. Cotton glove liners. Glove liners may be worn inside latex gloves for comfort, but should not be worn alone or considered as a layer of protection against contamination.
6. First pair of gloves. Place under coverall, tape coverall to glove.
7. Second pair of gloves. Place over coverall, tape to coverall.

When exiting the controlled area, carefully remove protective clothing so as not to transfer contamination from your protective clothing to your skin. Used protective clothing should be placed in a receptacle (e.g., poly bag) and left inside the control zone after use. Contaminated material left inside the control zone will be cleaned or disposed of in accordance with local procedures during the recovery phase of the incident. An example of how protective clothing may be removed can be found in the Decontamination, Disposal and Documentation Module.

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EMERGENCY EXPOSURE GUIDELINES

In extremely rare cases, emergency exposure to high levels of radiation may be necessary to rescue personnel or protect major property.

Rescue and recovery operations that involve radiological hazards can present responders with some complex issues to consider when trying to control personnel exposure. In these situations, the response type is generally left up to the officials in charge of the incident. Judgment is guided by many variables, which include considerations of risk versus benefit to determine personnel involvement.

The Environmental Protection Agency (EPA) has established guidelines for controlling emergency exposures. These exposure guidelines are summarized in the table below.

Guidelines for Control of Emergency Exposures

Dose Limit (rem)	Activity Performed	Condition
5 rem	All	
10 rem	Protection of major property	Where lower dose limit is not practicable
25 rem	Lifesaving or protection of large populations	Where lower dose limit is not practicable
>25 rem	Lifesaving or protection of large populations	Only on a voluntary basis to personnel fully aware of the risks involved

Source EPA 400-R-92-001

Check Your Understanding

1. Contamination _____ _____ should be established at the scene of an incident involving radioactive material to limit the spread of contamination and control access into the immediate hazard area.

2. For incidents involving radioactive material, the ERG recommends that the initial isolation zone should be established ____ to _____ feet around the spilled material.

3. Three basic protective measures that you can use to minimize the amount of external radiation exposure received at an incident involving radioactive material include minimizing the amount of _____ spent in the area; maintaining as much _____ as possible from the source of radiation; and using available _____.

4. The Environmental Protection Agency's guidelines for control of emergency exposures state that a responder may receive up to __ rem to save property.

5. _____ _____ should be worn when entering areas where radiological contamination is present or suspected.

6. One consideration when selecting protective clothing is _____ vs. _____.

M E R R T T




ANSWERS

1. control zones
2. 80 to 160
3. time
   distance
   shielding
4. 10
5. Protective clothing
6. decon
   disposal